

**Informal work-related injuries: a one year cohort study in a rural community in Serbia.**

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Acknowledgements: This project was part of the WHO Violence and Injury Prevention and Disability (VIP) Programme (but did not receive funding).

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### **Abstract**

Work-related injuries occurring during informal work often go unreported, yet lead to significant mortality and contribute substantially to disease burden due to injury-related disability. In Serbia, injury is a leading cause of death, with work-related injuries comprising a significant proportion. This study explored the frequency of and risk factors for these injuries in a rural Serbian community. During the 12-month study period, physicians from a municipal Primary Care Centre reported all presenting injuries using a specific injury report form. One in four injuries reported occurred during informal work practices, accounting for 71% of all reported work-related injuries. These occurred within the household in 85% of cases, and were more severe in males (79%). Regarding work-related injuries, informal workers were significantly older than formally employed workers, regardless of sex. Public policy should address safety improvements for informal workers, via provision of relevant training and protective equipment.

**Keywords:** work-related injuries; injury-related disability; informal employment; public health policy; accident prevention

## INTRODUCTION

The International Labour Organization (ILO) estimates 6,300 people die each day due to work-related injury or disease; a further 317 million workers sustain an injury in the work-place each year (International Labour Organization website, <http://www.ilo.org>, a). Globally, 90% of work-related injuries are experienced by men, particularly men of working age (15-59 years old).

Work-related injury not only leads to significant mortality but also contributes substantially to disease burden due to injury-related disability (Takala et al., 2016). In high-income countries, 8% of the total burden of injury is attributed to work-related injuries; this rises to 18% in low- and middle-income countries (World Health Organization, 2009). The economic consequences associated with work-related mortality and morbidity are staggering: global estimates suggest 4% of the global Gross Domestic Product is lost each year (International Labour Organization website, n.d.(a)); estimates are even higher if involuntary retirement is considered (Takala et al., 2016).

Relations between informal employment conditions and work-related health outcomes, including injuries, are seldom studied (Haton, 2015). While market labour is generally defined as paid work that is monitored and regulated by the state, there is neither a clear definition nor a consensus about how to define other types of labour, including informal work (De Beek & van Heuverswyn, 2001). Routine statistics about injuries related to informal work are usually not available whilst injuries are frequently noted in employed individuals, yet may be due to informal work conducted at home. Informal work is particularly prevalent in low- and middle-income countries as it can help supplement low wages. In rural communities, households often earn extra income by selling agricultural products produced in the household; alternatively,

families may privately consume these products and thus save on scarce income. According to the ILO, the informal economy comprises half to three-quarters of all non-agricultural employment in developing countries (International Labour Organization, n.d.(b)).

Most people engaged in the informal economy are exposed to certain hazards, including inadequate and unsafe work conditions, longer work shifts, less chance to access formal training, higher unemployment risk, as well as higher uncertainty in income stream (International Labour Organization, 2014, p.3). To date, relationships between informal employment conditions and work-related health outcomes have seldom been studied (di Porto, Elia & Tealdi, 2017), with a consequent gap in legislation related to occupational health and a gap in prevention of occupational injuries.

In Europe, work-related injuries are a significant health issue (Muntaner et al., 2010; European Association for Injury Prevention and Safety Promotion, 2013; Health and Safety Executive, 2016). In Serbia, where this research was undertaken, injury is the fifth leading cause of death, and work-related injuries are purported to comprise a significant proportion of the reported burden (Institute of Public Health of Serbia, 2015). However, in the absence of surveillance of work-related injuries in Serbia (Republic of Serbia, Ministry of Labour, Employment and Social Care, 2017), estimates are not robust. For example, the Commissariat for Work Safety and Health recorded only six fatalities and 818 serious injuries during 2012, whilst the National Health Insurance Fund reported 22 fatalities and 2,482 serious injuries.

Since 2008, Serbia has been affected by a significant economic crisis. This is partly due to the legacy of international sanctions and North Atlantic Treaty Organization (NATO) interventions

during the 1990s (GDP per capita (current US\$) dropped from 3179 US\$ in 1997 to 870 US\$ in 2000) (World Bank, n.d.). The Serbian GDP per capita growth has been in decline since 2008 (World Bank, n.d.) and in 2016, the total unemployment rate was 19.7%, and the youth unemployment rate was 44.2% (Statistical Office of the Republic of Serbia, 2016). Given significant unemployment in Serbia, there is an increasing likelihood of informal work. It is plausible to assume informal work also results in injuries, however there is a dearth of data available to suggest the likely impact of such work practices. This study aims to estimate the frequency of, and risk factors for, informal work-related injuries in a rural community in Serbia and to compare them with formal work-related injuries and all injuries.

## **METHODS**

### **Study design**

A one-year cohort study was conducted in the Municipality of Backi Petrovac, the Republic of Serbia. Physicians from the municipality's Primary Care Centre (PCC) were invited to complete a report form for each injury presented in their office during period of the study.

All injuries were classified as non-work-related and work-related, and work-related injuries were further classified as formal work-related and informal work-related (see Figure 1).

Non-work-related injuries included: vital activities (e.g. cooking, bathing, sleeping, etc.), travel, sport and leisure, educational activities and other activities (e.g. shopping, cultural activities, etc.).

A conceptual framework developed by the Seventh International Conference of Labour Statisticians was used to distinguish between formal and informal employment. (ILO, 2004, p.

15). According to this framework, informal work includes: own account workers in informal sector enterprises and in households, employers in informal sector enterprises, contributing family workers in both formal and informal sector enterprises, informal employees in any type of production units and members of producers' cooperatives in informal sector enterprises. Employees holding formal jobs in informal sector enterprises were not included in this group.

### **Setting and population**

The municipality of Backi Petrovac is situated in the northern part of Serbia in the Autonomous Province of Vojvodina. During the period under study, the municipality had a population of 13,418 inhabitants who resided in four settlements (Statistical Office of the Republic of Serbia, 2011). Approximately 36% (n=4,844) of the inhabitants were employed in formal work as follows: manufacturing (27%), agriculture (24%), commerce (12%), education (6%), healthcare (5%), public administration (5%), construction (5%) and other occupations (16%).

Primary and emergency healthcare in the municipality are solely provided at the municipal PCC. Primary care is provided by eight general practitioners and one paediatrician. Emergency care is also provided by the PCC through an urgent care service. Medical care that cannot be managed by the PCC is transferred to the Clinical Centre of Vojvodina in Novi Sad. It is estimated that more than 97% of Serbian citizens are covered by mandatory health insurance (National Health Insurance Fund) and have access to healthcare. Emergency healthcare is free of charge for all citizens, including the uninsured.

### **Data collection**

Between 1<sup>st</sup> October 2013 and 30<sup>th</sup> September 2014, residents of Municipality of Backi Petrovac who presented to the Primary Care Centre (PCC) due to an injury were identified and the physician from the PCC completed an injury report form, developed for the study. The physicians were asked to complete the report for each patient they treated who had sustained an injury, during or immediately following the patient's visit. Before the data collection process, the purpose of reporting and how to complete the form was explained to each physician.

Inclusion criteria were: resident in the municipality, of either sex and of any age and employment status; an injury that happened during the study period, either within or outwith the municipality; an injury presented either to primary care or to emergency care, or an injury initially presented outside PCC, but where there was evidence of an injury and the patient was able to provide additional data concerning the injury.

Exclusion criteria were: an injury presented at the PCC, but the patient was not a resident of the municipality; and/or an injury that happened before or after the study period.

The injury report included data concerning: the injured person (age, gender, marital status, education level, employment status, occupation); the time of injury (month, day and hour); place of injury (house, school, street/road, household, sport/recreational area, factory, farm, commercial area, countryside, other workplace); activity during which the injury occurred (formal or informal work, vital activities, educational activities, sport, leisure/play, travel); body part injured; external cause of the injury according to the International Classification of Diseases – 10<sup>th</sup> revision; alcohol use before the injury; nature of the injury (fracture, dislocation, cut, etc.); type of injury (sharp, blast, burn); whether first aid was applied, and if so, where this was provided (at home, in PCC, in hospital); and the severity level of the injury (Abbreviated Injury

Scale – AIS, that classifies an individual injury by body region according to its relative severity on a 6 point scale (1=minor and 6=maximal) (Association for the Advancement of Automotive Medicine, 2008).

Report forms were collected by the research team and entered into an Excel database, on a monthly basis. The PCC also operates a routine surveillance system which collects data on patient demographics along with limited injury data (date of injury and body part injured). Data from the routine surveillance system were consulted in addition to physician reports to calculate the coverage rate.

### **Data analysis**

Descriptive statistics of the sample studied, including estimation of the injury incidence by age and gender, are presented. Population data for the region were obtained from the 2011 Census (Statistical Office of the Republic of Serbia, 2011).

Reporting physicians categorized injuries as either work or non-work related and, depending upon the activity during which the injury occurred subsequently as ‘formal work’, ‘informal’ or non-work-related (vital activities, sport/leisure, education, travel, etc.).

In a small number of report forms (less than five per cent) some data were missing (age, place of injury), so for the analysis of some variables (e.g. age), the total number of observations is smaller than the overall number of reported injuries.

As appropriate, Chi-square and Fisher’s exact tests were used to explore associations between categorical variable groupings such as gender and work/non-work-related injury status, occupation, and work status. To assess differences in mean age between different patient groups,



an independent sample t-test was conducted. Analysis was undertaken using Stata 12 software and all probability testing was at the 0.05 significance level.

### **Ethical approval**

The study was approved by the Board Ethics of the PHC Centre Backi Petrovac.

### **RESULTS**

During the 12 month period, 254 injuries were reported. Eighty six (34%) were work-related, 25 of them (10% of all injuries, 29% of work-related injuries) related to formal and 61 to informal employment (24% of all injuries, 71% of work-related injuries) (Figure 2). Notably, injuries reported as work-related are predominantly associated with informal work ( $p<0.001$ ).

Insert Figure 2 about here

Demographic characteristics of the injured patient sample are presented in Table 1. Significant differences in injury frequency by type of work conducted (i.e. formal-informal-other activity) can be observed ( $p=0.02$ ): injuries are more frequent in males (79% for informal work-related injuries). The mean age between the work- and non-work-related injuries differs significantly across the sample ( $p<0.001$ ), with the mean age of males in the non-work-related injury group significantly higher ( $p<0.001$ ) than that in the work-related group. The mean age among patients reporting injuries due to informal work is significantly higher than that of patients incurring injuries during formal work or other activities ( $p<0.001$ ); this difference persists across gender groups ( $p<0.001$ ).

Insert Table 1 about here

More than 85% informal work-related injuries happened at home, while the same proportion of formal work-related injuries happened in a factory or other workplace (Table 2).

Insert Table 2 about here

The most common external cause of both formal and informal work-related injuries was exposure to inanimate force (e.g. struck by thrown, projected or falling object, caught, crushed, jammed or pinched in or between objects, contact hand tools and household machinery, etc.). Falls were twice as likely to be the cause of informal work-related injuries, while road traffic injuries related to work (including going to and from the workplace) were more frequent in formal employment (Table 3).

Insert Table 3 about here

Table 4 highlights the number of injuries sustained along with the injury type (e.g. fracture) and body part affected. Forty eight percent of injuries are classified as cuts, bites or other; the remaining 25% are described as bruises or superficial injuries. Associations between work and non-work-related injuries and injury types were explored, however no significant associations emerged. The frequency of injury by clinical fracture type differed significantly by the formal-informal-other activity classification of work ( $p=0.034$ ), with more injuries reported as being incurred during informal work and other activities.

Insert Table 4 about here

Injury classification by severity (and injury-incurring activity and work-related status) is summarized in Table 5. Notably, most injuries are classified as 1 on the AIS scale and the

proportion of injuries with the most severe scores (3 and 4) is almost twice that of informal work-related injuries.

Insert Table 5 about here

Figure 3 illustrates the yearly trend of injuries reported. A marked increase in reported injuries can be observed from September to October.

Insert Figure 3 about here

Formal work-related injuries are the most frequent on Friday, while informal work-related injuries are the most frequent on Saturday, but also frequent on all other days except Sunday (Figure 4).

Insert Figure 4 about here

## **DISCUSSION**

To address the substantial burden of work and non-work-related injuries, accurate incidence estimates are needed. This study shows that work-related injuries in a rural community in Serbia are predominantly associated with informal work. They are more common than any other type of injuries. Informal work is modestly present in high-income countries, but very common in low- and middle-income countries, where estimates suggest more than 50% of employed individuals are engaged in informal work (ILO, 2013). An earlier study in Brazil estimates the incidence rate of injuries in informal work at 6.2/100 full-time equivalent workers in contrast to 5.1/100 full-time equivalent workers for individuals engaged in formal work (Santana & Loomis, 2004).

In 2012, it was estimated that 17% of total employment in Serbia was informal, principally agricultural (Arandarenko, 2012). However, our study suggests that few informal work-related injuries occur on farms. Approximately 60% of informal work-related injuries happened at home. Similar findings were noted in Australia: Driscoll et al. (2003) suggested that home repairs, gardening and care were the most common unpaid activities which result in non-fatal injuries at home.

Our study found that informal work-related injuries were most common among the older male population – 79% of such injuries among males, with mean age 54, sixteen years higher than the mean age for formal work-related injuries, despite the fact that the unemployment rate is higher for the younger population. The unemployment ratio between under 25 population and 15-74 years old in Serbia was 2.5 (Centre for Liberal-Democratic Studies, 2016). There are several possible reasons for a high proportion of older population observed. Retirement rules in Serbia are characterised by relatively low standard and minimum retirement age thresholds, with no actuarial penalties for early retirement (Krstic et al., 2013) and an employment decline after 2000 in the public sector (and expected further decline in both public and private sector) (Gligorov, Ognjenovic & Vidovic, 2011). This incentivises pensioners to continue working after retirement, particularly in the informal sector, with an increasing number of young people who continue education or decide to migrate abroad and search for employment. Backi Petrovac is a typical municipality in Serbia which had developed industry before the 1990s, but which was devastated during 1990s and 2000s, when the proportion of employees in manufacturing decreased from 37% to 27% (National Health Insurance Fund, n.d.).

More than a half of the observed work-related injuries in our study were due to exposure to inanimate force. Every fifth injury in informal work was due to falls, compared with 10% of all injuries due to falls in formal work. A study from China showed that the four most common causes of injuries among agricultural machinery operators were being struck by starting handles that slipped, being slashed or stabbed by sharp objects, being struck by falling objects, and falls from stationary vehicles (Zheng et al., 2014).

Injuries in informal employment were more severe – more than 20% had an AIS score of 3 or 4. In a recent review of 17 studies focusing on the relationship between precarious work arrangements and work injuries, Quinlan, Mayhew and Bohle (2011) also found higher incidences of fatal, non-fatal, or more severe injuries than the referent group.

Being informally employed means not only to be at increased risk for health due to the lower chance of inappropriate training and injury protection. Workers informally employed also earn less (Krstic & Sanfey, 2010) and consequently it is expected that they will be less available to invest in their health improvement, including injury prevention.

It is not likely that informal work in Serbia will be reduced soon. Some of the reasons for this are the relatively high fiscal burden on labour, complicated and costly tax procedures, a complicated and opaque tax system, poorly organised, under-staffed, and under-equipped tax administration, poor quality of public services, and high tolerance for the shadow economy (Krstic et al., 2013). Once employed, an employee cannot expect many benefits; despite health insurance for employees, most of the health services are covered by health insurance only in public institutions, where access to healthcare is limited. An average pension for workers is 206 Euros, for self-employed persons, 194 Euros, and for agricultural workers, 86 Euros (Central Registry of

Compulsory Social Insurance, n.d.). There is also a current ban on employment in the public sector. All the above-mentioned factors demotivate both informal employers and informal workers from switching to formal employment – the result would be an additional costly financial burden for only limited benefits.

This study has several limitations. First, the rate of work-related injury (specifically formal work) may be under-estimated. Although it is estimated that nearly 100% residents of the municipality had access to PCC, a significant number of employees work outside the municipality and travel to work every day. Injuries that appear in these workers may be treated in health institutions outside the municipality and would therefore not be captured here. However, those injuries could be rather minor, as for each injury which requires absence from work, an injured person must report the injury to a PCC physician. Second, estimates of formal versus informal work may be compromised: in some cases, it was difficult to distinguish between formal and informal work as they nearly overlapped (i.e. self-employed agricultural workers who also work “informally” in their garden).

The coverage of all injuries registered in the PCC electronic health records during the study period was 20%. Notably, an underreporting of injuries was observed in the only town in the municipality where the majority of workers are employed in industry.

Injury prevention is of great national relevance in Serbia and increasingly recognized as a global health priority. Providing up to date measurements for injury incidence, as was done in this study, can assist policy makers in designing relevant injury prevention programs. Cohort studies and case-crossover design are two potential methodological approaches to measure incidence or risk factors for injuries related to informal work (Checkoway, Pearce & Kriebel, 2007).

This study illustrates that prevention programmes should not focus only on formal paid work; policy makers should target informal work in rural communities in low- and middle-income countries via bespoke initiatives. Many of the registered injuries, including these which were results of a fall, exposure to inanimate force or to foreign bodies, could have been prevented by appropriate training and by wearing protective equipment. An injury prevention approach as per De Beeck & Van Heuverswyn (2001), including information campaigns and participation, prevention performance measurement and life-long learning, may be adapted for this purpose. This could be rolled out alongside a broader community approach to increase awareness of risks related to informal work and to increase worker's knowledge and use of safety equipment during informal work in household. To ensure the success of such initiatives, however, policy makers need to officially recognize the existence of informal work and prioritize this as an area for injury prevention.

## **CONCLUSION**

A significant number of workers in low- and middle-income countries are engaged in informal work, yet there is insufficient information about the incidence of injuries and associated risk factors in informal work. In this study, 24% of all injuries and 71% of work-related injuries reported in the Municipality of Backi Petrovac, a rural community in Serbia, were related to informal unpaid work – most frequently conducted in households. They were registered mainly among older males and more severe than injuries related to formal work.

As it is not expected that a significant number of informal workers will switch to formal work, owing to continuing fluctuating rates in employment, we would suggest that there is a need for public policy to aim at improving safety for informal workers. This could be done via

occupational injury prevention programmes within local communities, targeting informal workers in rural areas, tailored to include training and information, around for example usage of tools, fall prevention, increased risks within the household, and provision of access to protective equipment. Additionally, provision of up-to-date measurements for injury incidence, such as those recorded in this study, can assist policy makers in officially recognising the existence of informal work, and in the design of relevant injury prevention programmes.

Further research into informal work and related risk factors is needed to inform the development of targeted injury prevention programmes.

### **Acknowledgements**

This project was part of the WHO Violence and Injury Prevention and Disability (VIP) Programme (but did not receive funding).

The authors would like to thank Ms. Claire McLellan, Queen Margaret University, Edinburgh, Institute for Global Health and Development, for language and grammar editing.



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**Figure 1: Flowchart – examples of formal and informal work-related injuries and non work-related injuries**

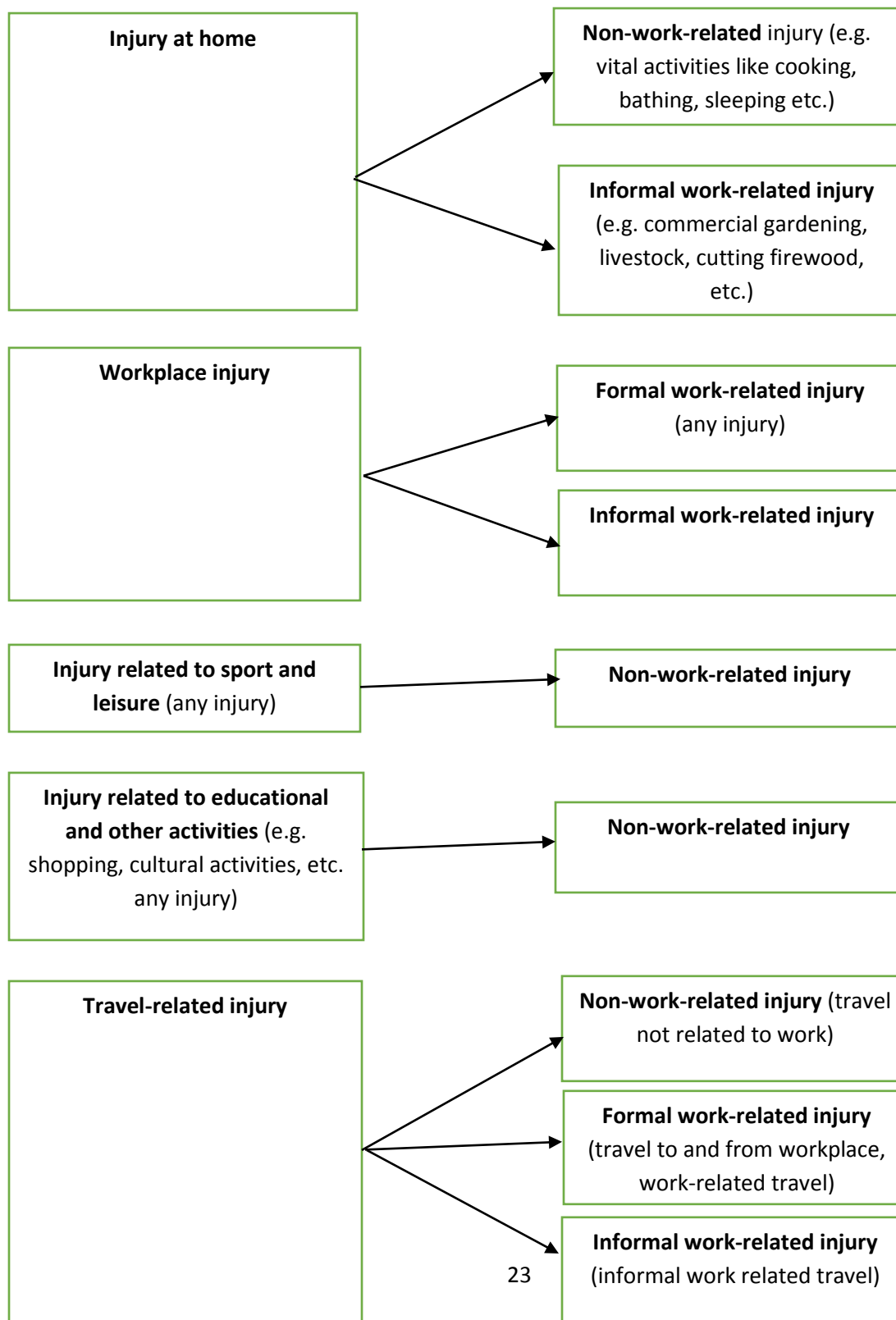


Figure 2 Types of activities incurring injuries

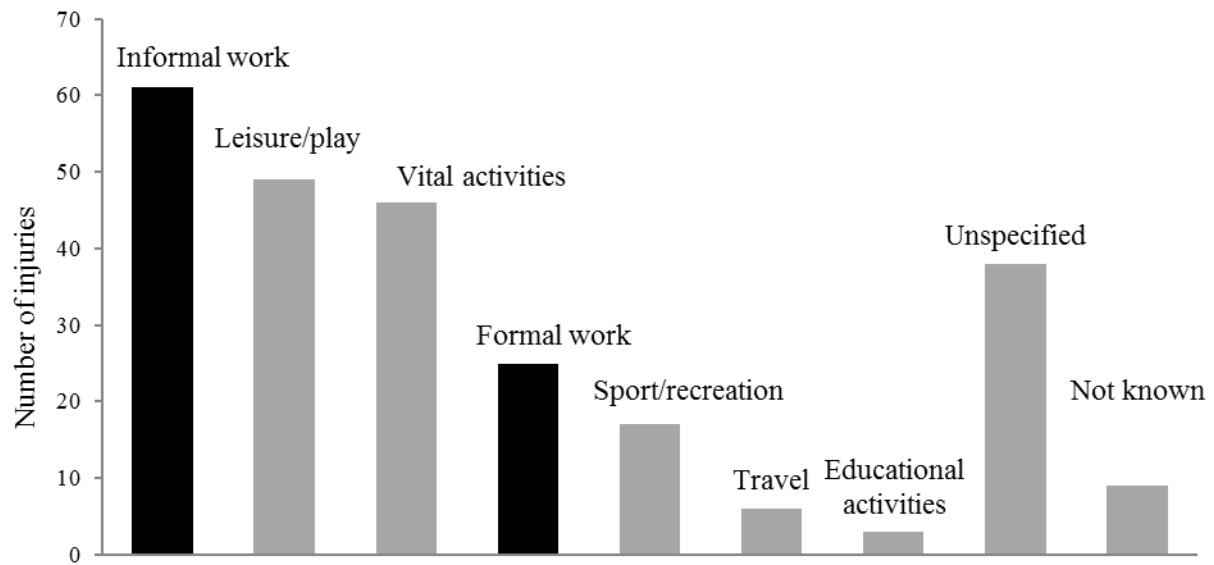




Figure 3. Number of injuries by month of injury

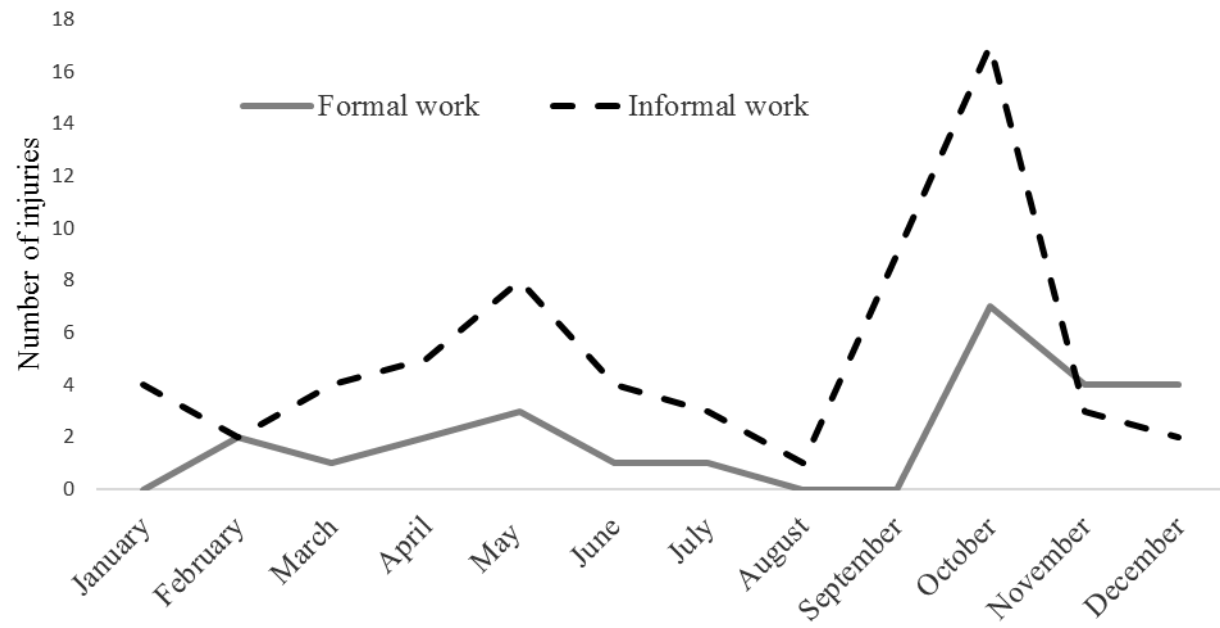


Figure 4. Number of injuries by day of week of injury

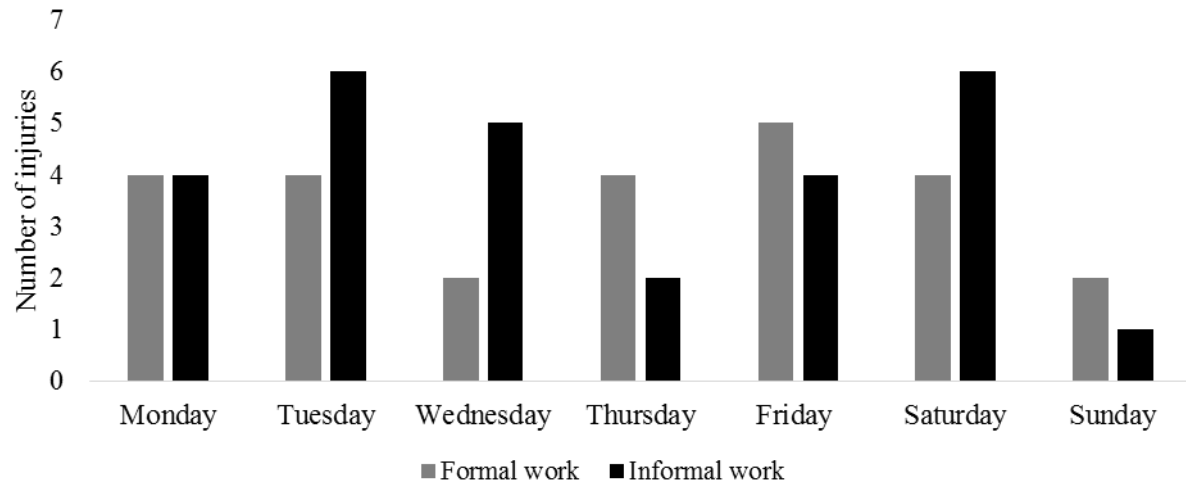


Table 1. Frequency, age and gender of patients with work and non-work related injuries.

<b>Gender</b>	<b>N (%)</b>	<b>Age range</b>	<b>Mean age</b>	<b>Median age</b>
<b>NOT work-related (n=168)</b>				
Male	99 (58.9)	(1 - 89)	34. 2 (SD 23.0)	31
Female	69 (41.1)	(1 - 86)	38.9 (SD 26.5)	39
<b>Work-related (n=86)</b>				
Male	66 (76.7)	(15 - 81)	49.7 (SD 17.5)	49
Female	20 (23.3)	(22 - 79)	47.5 (SD 15.2)	47.5
<b>Formal work (n=25)</b>				
Male	18 (72)	(20 - 65)	37.7 (SD 13.6)	36.5
Female	7 (28)	(22 - 49)	36.9 (12.4)	41
<b>Informal work (n=61)</b>				
Male	48 (78.7)	(15 - 81)	54.14 (16.5)	52.5
Female	13 (21.3)	(34 - 79)	53.23 (13.7)	50

Table 2. Frequency of work-related injuries by the place of injury.

Place of injury	Type of work				Ratio
	Formal work (%)		Informal work (%)		
	A (n)	B (%)	C (n)	D (%)	
At home	1	4	52	85.2	0.05
Street/road	2	8	2	3.28	2.44
Factory	6	24	0	0	-
Farm	1	4	7	11.5	0.35
Other workplace	15	60	0	0	-
TOTAL	25	100	61	100	-

Table 3. External cause of work-related injuries.

Cause of work-related injury	Formal work-related injuries (%)		Informal work-related injuries (%)		Ratio
	A (n)	B (%)	C (n)	D (%)	B/D
Transport related	3	14.3	2	4.7	3.07
Falls	2	9.5	9	20.9	0.45
Exposure to inanimate force	12	57.2	26	60.5	0.95
Foreign bodies	2	9.5	3	6.9	1.36
Exposure to live force	1	4.8	2	4.6	1.02
Exposure to fire, flames and contact with heat or hot substances	1	4.8	0	0	-
Excessive effort and privation	0	0	1	2.3	-
TOTAL	21	100	43	100	-

Table 4. Clinical types of work and non-work related injuries.

<b>Clinical type of injury</b>	<b>Formal work</b>	<b>%</b>	<b>Informal work</b>	<b>%</b>	<b>Ratio</b>
	<b>A (n)</b>	<b>B (%)</b>	<b>C (n)</b>	<b>D (%)</b>	<b>B/D</b>
Fracture	1	4	11	18.0	0.22
Sprain or strain	2	8	1	1.6	4.88
Cut, bite, other open	15	60	36	59.0	1.02
Bruise or superficial	5	20	13	21.3	0.94
Burn	2	8	0	0	-
<b>TOTAL</b>	<b>25</b>	<b>100</b>	<b>61</b>	<b>100</b>	<b>-</b>

Table 5. Severity of reported injuries by work status.

<b>AIS</b>	<b>Formal</b>	<b>%</b>	<b>Informal</b>	<b>%</b>	<b>Ratio</b>
<b>Score</b>	<b>work</b>		<b>work</b>		
	<b>A (n)</b>	<b>B (%)</b>	<b>C (n)</b>	<b>D (%)</b>	<b>B/D</b>
0	0	0	1	1.6	-
1	17	68	38	62.3	1.09
2	5	20	9	14.8	1.36
3	0	0	7	11.5	-
4	3	12	6	9.8	1.22
<b>TOTAL</b>	<b>25</b>	<b>100</b>	<b>61</b>	<b>100</b>	<b>-</b>